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Indian Standard

SPECIFICATION FOR HIGH TENSION CONNECTING WIRES FOR USE IN TELEVISION RECEIVERS

UDC 621·315 336·9 : 678·073 : 621·397·62

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1980

AMENDMENT NO. 1 OCTOBER 1985

TO

IS:9566-1980 SPECIFICATION FOR HIGH TENSION CONNECTING WIRES FOR USE IN TELEVISION RECEIVERS

(*Page 5, clause 3.4, first sentence*) - Substitute the following for the existing sentence:

'The insulation shall be covered by a flame retarding general purpose sheath for 70°C operation'.

[*Page 5, foot-note with dagger* (†) *mark*] - Delete.

(LTDC 18)

Reprography Unit, ISI, New Delhi, India

Indian Standard

SPECIFICATION FOR HIGH TENSION CONNECTING WIRES FOR USE IN TELEVISION RECEIVERS

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(*Continued on page* 2)

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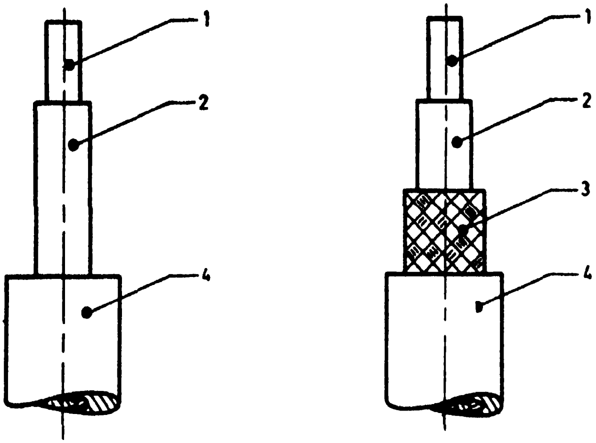
2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 1885 (Part XXXII)-1971* shall apply.

3. CONSTRUCTION

3.0 The types of construction for the unscreened and screened wires are shown in Fig. 1.



1 — Inner conductor

2 — Polyethylene insulation

3 — Screening

4 — Flame retarding PVC sheath

1A Without Screen, Sheathed

1B With Screen, Sheathed

FIG. 1 TYPES OF CONSTRUCTION

3.1 Conductor — The inner conductor shall consist of a solid or stranded plain annealed copper wire of sizes given in Table 1.

NOTE — The physical constants of the copper material are given in Appendix A.

3.2 Insulation — The insulation shall be of polyethylene conforming to IS : 6474-1971†. The insulation shall be continuous having a uniform thickness. It shall be free from flaws, such as pin holes and occlusion of stray matters. It shall have adequate mechanical strength and elasticity.

---

*Electrotechnical vocabulary: Part XXXII Cables, conductors and accessories for electricity supply.

†Specification for polyethylene insulation and sheath of electric cables.

The insulation shall be applied to fit closely to the conductors without adhering to it. It shall be possible to strip the insulation readily without damaging the conductor, leaving the conductor clean for soldering.

The nominal wall thickness of insulation and the maximum diameter over insulation shall be as given in Table 2.

TABLE 1 DIMENSIONS AND CHARACTERISTICS OF INNER CONDUCTOR

(*Clauses* 3.1, 6.3.1 *and* 6.3.2.1)

RATED VOLTAGE	CONDUCTOR DIAMETER			CONDUCTOR RESISTANCE, *Max*	ELONGATION AT BREAK, *Min*
	Nom	*Min*	*Max*		
(1)	(2)	(3)	(4)	(5)	(6)
kV	mm	mm	mm	Ω/km	percent
20	0·5 solid	0·48	0·52	90·43	18
	7 × 0·2 stranded	0·58	0·62	84·66	9

3.3 Screen (Where Specified) — The filling factor shall be at least 0·70. The braid angle shall be 45° (*see* **2.9** of IS : 5026-1969*).

The diameter of the individual braid wires shall be 0·125 mm.

The braid shall consist of plain annealed copper wires.

3.4 Sheath — The insulation shall be covered by a flame retarding PVC sheath conforming to Type 6 of IS : 5831-1970†. The sheath shall be continuous having a uniform thickness. The sheath shall have adequate mechanical strength and elasticity.

The core shall be protected before sheathing by a barrier of polyester film tape or unplasticized PVC tape or similar material not more than 0·03 mm in thickness, in such a manner that each turn of the tape overlaps the preceding turn by at least one-fifth of the width of the tape. The tape shall not adhere to the core.

NOTE — The use of barrier tape/film is optional.

The protective PVC sheathing shall be free from surface irregularities and be completely regular in shape.

The maximum diameter over sheath shall be as given in Table 2.

---

*General requirements and tests for radio frequency cables.

†Specification for PVC insulation and sheath of electric cables.

TABLE 2 DIMENSIONS AND CHARACTERISTICS OF DIELECTRIC AND SHEATH

(*Clauses* 3.2, 3.4, 6.3.2.2, 6.3.4, 6.4.1 *and* 6.4.2)

RATED VOLTAGE	DIELECTRIC		SHEATH DIAMETER, *Max*		DC* TEST VOLTAGE	INSULATION RESISTANCE, *Min*	TENSILE STRENGTH, *Min*		ELONGATION AT BREAK, *Min*		FLEXIBILITY	
	Wall Thickness, *Nom*	Diameter, *Max*	Unscreened	Screened			Insulation	Sheath	Insulation	Sheath	Mandrel Diameter	DC Test Voltage
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
kV	mm	mm	mm	mm	kV	MΩ	N/cm^2	N/cm^2	percent	percent	mm	kV
20	1·0	3·2	4·0	4·7	40	104	1 000	980	350	150	30	25

*The ac test voltage is under consideration.

4. ENGINEERING DATA

4.1 The nominal capacitance between the conductor and the screen of the screened wire measured at 20 ± 2°C and at a frequency of 1 kHz is 90 pF/m.

5. PACKING AND MARKING

5.1 Packing — The high tension connecting wire shall be supplied on reels or coils, suitably packed and labelled.

5.2 Marking — The label which shall be securely attached to the reel or coil shall carry the following information:

a) Manufacturer's name or trade-mark,
b) Nominal cross-sectional area of the wire,
c) Colour of the wire,
d) Length of the wire contained in each coil or reel, and
e) Country of manufacture.

5.2.1 The label may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5.3 Manufacturer's Identification — The manufacturer's name or trade-mark shall be embossed on the cable at least once in each metre length of the cable.

6. TESTS

6.1 Atmospheric Conditions for Testing — The electrical and mechanical tests shall be carried out at the standard atmospheric conditions for testing, that is, at a temperature between 15 and 35°C and relative humidity of 45 to 75 percent, unless otherwise specified.

NOTE — The requirements for dielectric strength have been chosen in a way that the wire may be operated at atmospheric pressure above 70 kPa, although the test is performed at normal atmospheric pressure.

Before the measurements are made, the connecting wires shall be stored at the measuring temperature for a time sufficient to allow the entire wire to reach this temperature. When measurements are made at a temperature other than the reference temperature, the result shall, where necessary, be corrected to the reference temperature.

NOTE — Where it is impracticable to carry out tests under the standard atmospheric conditions for testing, a note to this effect, stating the actual conditions of tests, shall be added to the test report. In case of doubt, tests shall be carried out only under standard atmospheric conditions.

6.2 Classification of Tests

6.2.1 *Type Tests* — The following shall constitute the type tests:

a) *Mechanical and Physical Tests*

   1) Dimensions (**6.3.1**),
   2) Tensile strength (**6.3.2**),
   3) Flammability (**6.3.3**),
   4) Flexibility (**6.3.4**), and
   5) Displacement of inner conductor (flow test) (**6.3.5**);

b) *Electrical Tests*

   1) Dielectric strength (**6.4.1**),
   2) Insulation resistance (**6.4.2**), and
   3) Resistance of inner conductor (**6.4.3**);

c) Thermal endurance (**6.5**);
d) Corona (**6.6**); and
e) Ultraviolet stability (**6.7**).

6.2.1.1 *Number of samples* — For type tests, samples of suitable lengths shall be taken from 5 reels/coils each containing one continuous length of the given type of wire.

These reels/coils shall be selected at random from regular production lots so as to be as representative as possible of the type under consideration. Each reel/coil shall be subjected to all the tests specified in **6.2.1.**

In the event of any one of the reels/coils failing to comply with the requirements in any respect; a further set of 5 reels/coils shall be taken all of which shall be again subjected to all the tests specified in **6.2.1.** If no single failure occurs, the type shall be considered as approved.

6.2.2 *Acceptance Tests* — The acceptance tests shall be carried out on samples which have already passed the routine tests. The following shall constitute the acceptance tests:

a) Dimensions (**6.3.1**),
b) Tensile strength (**6.3.2**),
c) Flexibility (**6.3.4**),
d) Dielectic strength (**6.4.1**),
e) Insulation resistance (**6.4.2**), and
f) Resistance of inner conductor (**6.4.3**).

6.2.2.1 *Sampling plan* — A recommended sampling plan for acceptance tests is given in Appendix B.

6.2.3 *Routine Tests* — The following shall constitute the routine tests:

a) Dielectric strength (**6.4.1**),
b) Insulation resistance (**6.4.2**), and
c) Resistance of inner conductor (**6.4.3**).

6.3 Mechanical and Physical Tests

6.3.1 *Dimensions* — The wires shall be checked for conformity with the dimensions specified in Table 1.

6.3.2 *Tensile Strength*

6.3.2.1 *Inner conductor* — A sample of the inner conductor shall be placed in a tensile machine with a minimum length of 250 mm between the jaws and shall be steadily elongated at a speed of approximately 10 cm/min until the wire breaks.

The minimum elongation at break shall be in accordance with Table 1.

6.3.2.2 *Insulation and sheath* — The tensile test shall be carried out on samples of the insulation after removal of the inner conductor and the screen, if any. The sheath shall be cut open in the longitudinal direction.

The test shall be made under the following conditions:

Test temperature	25 ± 2°C
Initial length between jaws	10 cm
Speed of the tensile machine approximately	30 cm/min

The measured tensile strength and elongation at break shall be not less than the values given in Table 2.

6.3.3 *Flammability* — The test is made on three samples of the complete wire, each approximately 60 cm long.

The test is made in still air with a Bunsen burner, having a nozzle with an internal diameter of approximately 9 mm, burning liquefied petrol gas or coal gas. With the burner in the vertical position, the flame is adjusted to an overall length of approximately 10 cm and a cone length of about 5 cm.

The burner is then supported so that its axis is at an angle of 45° with the vertical. The sample is held at an angle of 45° with the vertical, its axis being in a vertical plane perpendicular to the vertical plane containing the axis of the burner. Its position is such that it passes through the centre of the flame 10 cm from its lower end, the distance between the sample and the nozzle of the burner being 3·5 cm. The sample is held in the flame for 15 seconds.

If the cable, after removal of the flame continues to burn, it shall extinguish in 15 seconds or less and the charred length shall not exceed 75 mm.

6.3.4 *Flexibility* — A sample of wire having a length of at least 100 cm shall be wound at room temperature into a close helix of 10 turns round a metal mandrel having diameter as given in Table 2. This sample shall then be kept for 24 hours at a temperature as specified in Table 3 followed by 4 hours at room temperature. After this ageing period, the wire shall withstand for 5 minutes a dc voltage given in Table 2 when applied between conductor and mandrel for unscreened wires and between conductor and screen for screened wires.

TABLE 3 TEMPERATURE TO BE APPLIED

(*Clauses* 6.3.4, 6.3.5 *and* 6.5)

FLEXIBILITY	DISPLACEMENT OF INNER CONDUCTOR	THERMAL ENDURANCE
85 ± 2°C	Under consideration	85 ± 2°C

6.3.5 *Displacement of Inner Conductor* (*Flow Test*) — The test shall be made on a sample of the wire having a minimum length of 100 cm, after removal of screen (if any) and sheath. The sample is wound for half a turn around a pre-heated metal mandrel having a diameter of 15 mm.

The temperature of the mandrel shall be in accordance with Table 3. This temperature shall be maintained during the test period. A weight of 20 N shall be attached to each free end of the inner conductor of the sample.

A voltage of 500 V dc shall be applied between conductor and mandrel. No breakdown shall occur in 10 minutes.

6.4 Electrical Tests

6.4.1 *Dielectric Strength* — This test shall be carried out before the measurement of the insulation resistance (*see* **6.4.2**) is made.

A sample of cable having a minimum length of 10 m shall be immersed for 24 hours in water at room temperature. After this conditioning, the test sample is immersed for 5 minutes in water at 85 ± 2°C. During the immersion, the ends of the cable shall protrude by at least 10 cm from the tank.

The test voltage shall be applied progressively between conductor and water for unscreened wire, and between conductor and screen for screened wire.

The wire shall withstand for 5 minutes a test voltage as specified in Table 2. For routine test, however, the complete production length of the cable shall be subjected to a test voltage of 23 kV dc for 5 minutes.

6.4.2 *Insulation Resistance* — The measurement shall be made after the dielectric strength test (*see* **6.4.1**), the sample being kept immersed in water at 85 ± 2°C.

The voltage shall be applied between the inner conductor and water for unscreened wire, and between the inner conductor and the screen for screened wire.

The measurement shall be made 5 minutes after the application of a voltage of 500 V dc.

The minimum insulation resistance shall be in accordance with Table 2.

6.4.3 *Resistance of Inner Conductor* — The electrical resistance of the inner conductor shall be measured on the finished cable and corrected to the standard reference temperature of 20°C.

The resistance of the conductor at 20°C shall not exceed the maximum value specified in Table 1.

6.5 Thermal Endurance — A sample of the wire having a length of 30 cm shall be heated to a temperature specified in Table 3 for 30 days. After cooling down to room temperature, the cable shall be wound for 3 turns on a mandrel with a diameter of 9 mm at a rate of 1 rev/s. After winding, there shall be no visible deterioration, such as, cracks.

6.6 Corona — Under consideration.

6.7 Ultraviolet Stability — Under consideration.

APPENDIX A

(*Clause* 3.1, *Note*)

INTERNATIONAL STANDARDS FOR COPPER

A-1. The following values adopted by the International Electrotechnical Commission (IEC publication No. 28) for standard annealed copper have been taken as standard for annealed high conductivity copper:

a) At a temperature of 20°C, the volume resistivity of standard copper is 1/58 = 0·017 241 ohm.mm^2/m. Copper which has a resistivity at 20°C of 1/58 (0·017 241 ohm.mm^2/m) is said to have a conductivity of 100 percent.

b) At a temperature of 20°C, the density of standard annealed copper is 8·89 g/cm^3.

c) At a temperature of 20°C, the coefficient of linear expansion of standard copper is 0·000 017/°C.

NOTE — The above value of the coefficient of linear expansion may be applied to annealed copper over a temperature range from 0 to 150°C.

d) At a temperature of 20°C, the coefficient of variation of resistance with temperature of standard annealed copper, measured between two potential points rigidly fixed to the wire, the metal being allowed to expand freely, is:

$$0{\cdot}003\,93 = \frac{1}{254{\cdot}45}\,/^\circ\mathrm{C}$$

e) As a consequence it follows from (a) and (b) that at a temperature of 20°C the mass resistivity of standard annealed copper is:

$$1/58 \times 8{\cdot}89 = 0{\cdot}153\,28\ \mathrm{ohm.g/m^2}$$

APPENDIX B

(*Clause* 6.2.2.1)

RECOMMENDED SAMPLING PLAN

B-1. LOT

B-1.1 In any consignment, all the reels or coils manufactured from the same materials under essentially similar conditions of production shall be grouped together to constitute a lot.

B-2. SCALE OF SAMPLING

B-2.1 For judging the conformity of a lot to the requirements of the specification, tests shall be done for each lot separately. For this purpose the number of reels or coils to be selected at random from a lot shall be in accordance with col 1 and 2 of Table 4.

TABLE 4 SCALE OF SAMPLING AND ACCEPTANCE NUMBER

(*Clauses* B-2.1, B-3.1 *and* B-3.2)

Lot Size	Scale A		Scale B, Sample Size
	Sample Size	Acceptance Number	
(1)	(2)	(3)	(4)
Up to 50	8	0	5
51 „ 100	13	0	5
101 „ 150	20	0	8
151 and above	32	1	13

B-3. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-3.1 From each of the reels or coils selected according to col 1 and 2 of Table 4, suitable lengths of test samples shall be taken after discarding approximately 1·5 m of the wire from both ends. Each of these test samples shall be subjected to the measurement of dimensions, dielectric strength, resistance of inner conductors and insulation resistance. The lot shall be considered as conforming to the requirements of dimensions, resistance of inner conductors and insulation resistance, if the number of failures in any of these tests is less than or equal to the acceptance number given in col 3. For dielectric strength, all the test samples shall pass.

B-3.2 For the test for tensile strength, the number of test samples shall be in accordance with col 1 and 4 of Table 4. The lot shall be considered as conforming to this requirement if all the test samples pass.

Note — The test samples for the purpose of **B-3.2** may be chosen from the reels or coils already selected for the purpose of **B-3.1**.

INDIAN STANDARDS

ON

WIRES AND CABLES FOR ELECTRONIC EQUIPMENT

IS:

5026-1969 General requirements and tests for radio frequency cables
5608 Low frequency wires and cables with PVC insulation and PVC sheath
5608 (Part I)-1970 Part I General requirements and tests
5608 (Part II)-1970 Part II Equipment wires, single
5608 (Part III)-1976 Part III Equipment wires and cables, screened
5662-1970 TV aerial feeder cables
5801 Flexible coaxial radio frequency cables with characteristic impedance 50Ω
5801 (Part I)-1970 Part I Cables type 50-3-1
5801 (Part II)-1970 Part II Cables type 50-3-2
5801 (Part III)-1970 Part III Cables type 50-7-1
5802 Flexible coaxial radio frequency cables with characteristic impedance 75Ω
5802 (Part I)-1970 Part I Cable type 75-7-1
5802 (Part II)-1975 Part II Cable type 75-7-2
8080-1976 Silver coated copper wire
9566-1980 High tension connecting wires for use in television receivers
9567-1980 Tin or tin-lead coated copper wire

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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